

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA1 | Euston - Station and Approach

Water resources assessment (WR-002-001)

Water resources

November 2013

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Department
for Transport

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1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

- 1.1.1 The water resources and flood risk assessment appendices comprise three parts. The first of these is a route-wide appendix (Appendix WR-001-000).
- 1.1.2 Specific appendices for the Euston - Station and Approach community forum area (CFA1) are also provided. These are:
- a water resources assessment (i.e. this appendix); and
 - a flood risk assessment (Appendix WR-003-001)
- 1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5, Water Resources and Flood Risk Assessment Map Book.

1.2 Study area

- 1.2.1 CFA1 covers approximately 1.3km of the route from Euston Station north of the Euston Road to the Park Street tunnels, where Parkway crosses the existing railway. It is entirely within the London Borough of Camden.
- 1.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area.
- 1.2.3 The main environmental features of relevance to water resources within the study area comprise:
- Grand Union Canal (GUC) (the Regent's Canal);
 - the Chalk Principal aquifer;
 - the Lambeth Group and Thanet Sand Formation Secondary A aquifers; and
 - the Lynch Hill Gravel Member Secondary A aquifer.
- 1.2.4 Key environmental issues relating to water resources include:
- the potential impacts to surface water quality; and
 - the potential impacts to groundwater quality.

- 1.2.5 Where a residual impact or mitigation for water resources has a consequent effect on ecology, this is discussed further in Volume 2, Euston - Station and Approach (CFA Report 1), Section 7.

2 Stakeholder engagement

2.1.1 Discussions have been held with the following stakeholders to inform the water resources and flooding assessment:

- the Environment Agency;
- Thames Water Utilities Ltd; and
- the Canal & River Trust (formerly British Waterways) with regard to the Regent's Canal.

3 Baseline data

3.1 General

- 3.1.1 The following section provides a current description of water resources within the study area including surface water and groundwater features.
- 3.1.2 All water bodies in this area fall within the London sub-catchment of the Thames River Basin District (RBD) as defined under the Water Framework Directive¹ (WFD) and are covered by the River Basin Management Plan² (RBMP).

3.2 Surface water features

- 3.2.1 All surface water features within 500m of the route are presented in Table 1.
- 3.2.2 The current surface water baseline is shown on Map WR-01-001 (Volume 5, Water Resources and Flood Risk Assessment Map Book). Water features with codes listed in Table 1 are shown on Map WR-01-001 (Volume 5, Water Resources and Flood Risk Assessment Map Book). The map reference is in one of two forms. If the feature has a specific reference number then this is provided (e.g. a surface water crossing will be referenced as SWC-CFA01-01). If the feature has no specific reference its location on a specific map is provided (e.g. WR-01-001, D6) where D6 is a grid reference using the map specific grid.
- 3.2.3 The surface water features are based on the Environment Agency's Detailed River Network (DRN) with the addition of water bodies noted on the Ordnance Survey's (OS) 'OS VectorMapDistrict'.

¹ Water Framework Directive - *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*, Strasbourg, European Parliament and European Council

² Environment Agency (2009) *River Basin Management Plan, Thames River Basin District*

Table 1: Surface water features within 500m of the route in the study area

Water feature	Location description (Volume 5 Water Resources and Flood Risk Map Book map reference)	Watercourse classification ³	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value ⁴	Q ₉₅ ⁵ (m ³ /s)	Catchment area at crossing (km ²)	Notes
GUC (the Regent's Canal)	The Regent's Canal is located north of Regent's Park and close to the boundary of this study area. See Map-01-001	Artificial	GUC, Uxbridge to Hanwell Locks, Slough Arm, Paddington Arm. GB70610078 Moderate	Good potential	High	Not applicable	Not applicable	Will not be crossed by the Proposed Scheme in the study area
Ponds and lakes	Located within Regent's Park and London Zoo. CFA01-P01 as shown on Map-01-001	Not applicable	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate	Not applicable	Not applicable	Isolated ponds not impacted by the Proposed Scheme.

³ Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a Main river as a watercourse that is shown as such on a Main river map. Section 72 of the Land Drainage Act 1991 defines an Ordinary watercourse as 'a watercourse that is not part of a Main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including 'all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by the Department for Environment, Food and Rural Affairs (Defra) on the Main river map and are regulated by the Environment Agency

⁴ For examples of receptor value, see Table 43 in the Scope and Methodology Report (SMR) Addendum, Volume 5: Appendix CT-001-000/2.

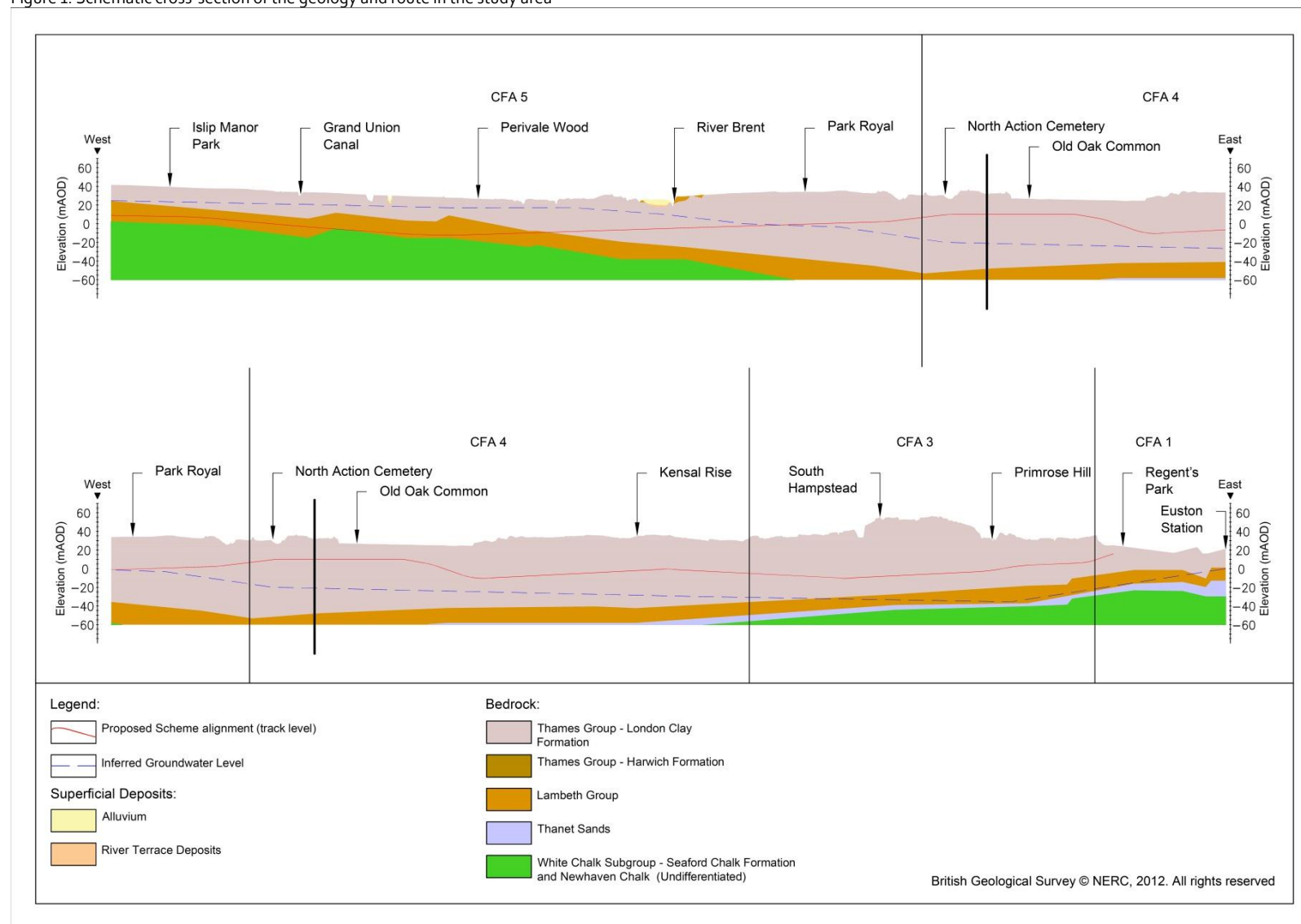
⁵ Q₉₅ is the flow which is exceeded for 95% of the time (i.e. it is a low flow and the river will only have flows less than this for 5% of the time).

- 3.2.4 No current surface water abstractions or discharge consents have been identified in the study area⁶. There is the potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.
- 3.2.5 A summary of the geological units present in the study area, along with their hydrogeological characteristics, is presented in Volume 2, CFA Report 1, Section 8.
- 3.2.6 Map WR-02-001 (Volume 5, Water Resources and Flood Risk Assessment Map Book) illustrates the spatial distribution of the uppermost superficial and bedrock formations within the study area.
- 3.2.7 Superficial deposits comprising the Langley Silt Member and the Lynch Hill Gravel Member of the Maidenhead Formation are present in the southern part of the study area.
- 3.2.8 The Lynch Hill Gravel is classified as a Secondary A aquifer, but is considered to be of low value due to its limited extent and potentially poor water quality. The Langley Silt Member is classified as unproductive strata.
- 3.2.9 The London Clay Formation underlies the whole of the study area. It is a blue-grey clay that weathers to a brown colour in its upper part.
- 3.2.10 The geological succession beneath the London Clay Formation comprises, in turn the:
- Harwich Formation, a thin sandy deposit which may be present in some locations;
 - Lambeth Group (also termed the Upnor, Woolwich and Reading Formations) which comprises mixed sands and clays, and pebble deposits in some locations;
 - Thanet Sand Formation, a greenish or brownish grey, silty, fine-grained sand; and
 - White Chalk Subgroup, a succession of soft white limestones.
- 3.2.11 A schematic cross-section along the line of the route in this area showing geological strata, groundwater levels (where known) and the location of the Proposed Scheme is presented in Figure 1. Figure 2 presents the groundwater elevation contours in the Chalk aquifer for this study area and adjacent areas using data from January 2012⁷. It should be noted that the Chalk is confined so the apparent water level is a representation of the water level that would be observed if the Chalk was penetrated by a borehole. It is not indicative of groundwater being present in the London Clay. Groundwater flow in the study area is towards the south as shown by the groundwater elevation contours in Figure 2.

⁶ Surface water abstractions for public supply are not included.

⁷ Environment Agency (2013), *Management of the London Basin Chalk Aquifer Status Report 2013*

Figure 1: Schematic cross-section of the geology and route in the study area





- 3.2.12 Table 2 summarises licensed groundwater abstractions and groundwater source protection zones (SPZ) located within 1km of the route. There is the potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

Table 2: Licensed groundwater abstractions

Licence identifier (map reference number and Environment Agency reference)	Distance and direction from route (m)	Abstraction horizon	Max annual abstraction quantity (m ³)	Max daily abstraction quantity (m ³ /d)	Purpose	Number of boreholes
Public water supplies (PWS)						
SPZ located north of Regent's Park as shown on map WR-02-001, D6 (Licence number confidential)	SPZ1 will be 920m west of the route and SPZ2 will be 840m west of the route in the study area. The source is located in the Primrose Hill to Kilburn (Camden) CFA (CFA3)	Chalk	631,000m ³	2,000 m ³	PWS	1
Private abstractions						
GW92 (TH/039/0039/001)	380m east	Chalk	327,600 m ³	1,260 m ³	Heat pump	1
GW88 and GW89 (TH/039/0039/031)	750m south-east	Chalk	203,407 m ³	558 m ³	Heat pump	2
Gw85 (TH/039/0039/010)	880m south-west	Chalk	50,000 m ³	400 m ³	Heat pump	1
GW78 (TH/039/0039/022)	980m south-west	Assumed Chalk	118,260 m ³	324 m ³	Heat pump	1

- 3.2.13 Table 3 summarises groundwater discharge consents for discharge direct to groundwater or via land, within 1km of the route.

Table 3: Discharge consents to groundwater

Reference number	Permit identifier	Distance and direction from route (m)	Discharge type	Receiving water body
CFA1WD4	Npswqd005471	310m east	Trade discharges - cooling water	Groundwater via re-injection borehole
CFA1WD6	Npswqd007488	870m south-west	Trade discharges - cooling water	Groundwater
CFA1WD9	Eprgp3123kg	720m south	Trade discharges - cooling water	Groundwater
CFA1WD11	Eprgp3123kg	720m south	Trade discharges - cooling water	Groundwater

3.3 Surface water/groundwater interaction

- 3.3.1 No surface water/groundwater interactions have been identified within 500m of the route in the study area.

3.4 Water dependent habitats

- 3.4.1 No water dependent habitats have been identified in the study area.

4 Site specific assessments

4.1 Surface water

- 4.1.1 Table 4 summarises all potential impacts and effects to surface water features from the Proposed Scheme in the study area. Only those impacts and effects that are classed as significant are presented in Volume 2, CFA Report 1, Section 13.
- 4.1.2 Table 4 only includes water features which could potentially be impacted by the Proposed Scheme. Features such as isolated ponds and drains which will lie outside the construction footprint and area of impact of the Proposed Scheme are not included. Details of the features, however, are provided in Table 1.
- 4.1.3 The draft Code of Construction Practice (CoCP), referred to in Table 4, sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (see Volume 5: Appendix CT-003-000/1). These will provide effective management and control of the impacts during the construction period.

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Table 4: Summary of potential impacts to surface water

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Water features									
GUC (the Regent's Canal)	High	Demolition of buildings, bridges and part of Euston Station. Construction - main construction compounds, satellite construction compounds, utility construction zone and temporary construction access.	No works directly adjacent to the Regent's Canal so limited potential for surface water flow and quality effects.	Negligible impact Neutral effect (Not significant)	Appropriate mitigation in the draft CoCP, for polluting materials, management of earthworks and rate of surface runoff.	Negligible impact Neutral effect (Not significant)	None	None	Not applicable
Ponds and lakes located within Regent's Park and London Zoo CFA01-P01	Moderate	Construction activities at Euston Station and Euston portal.	Features are not hydraulically connected to areas where construction will take place so no potential for impacts.	Negligible impact Neutral effect (Not significant)	None required as no hydraulic connection and no impact.	Negligible impact Neutral effect (Not significant)	None	None	Not applicable

5 Site specific groundwater assessments

5.1 Summary of assessment

- 5.1.1 Table 5 summarises the potential impacts to hydrogeology (groundwater), and abstractions.

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Table 5: Summary of potential impacts to groundwater receptors

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Hydrogeology (groundwater)									
Lambeth Group Secondary A aquifer Thanet Sand Formation Secondary A aquifer White Chalk Subgroup Principal aquifer	High (assessed against highest value receptor) - the Chalk Principal aquifer	Basement above London Underground (LU) platform tunnels and connecting escalators and passages.	The basement will extend to approximately 8m above Ordnance Datum (AOD), which is in the London Clay Formation. The top of the Lambeth Group is at approximately 0m AOD at this point. Local depressurisation of low to medium permeability strata may be required but the Lambeth and Chalk aquifers will not be pumped. Groundwater levels for the bedrock aquifers are between -30 and -40m AOD. No groundwater should be penetrated. Consequently construction will have a negligible impact on groundwater flow and quality.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	None	None	Not applicable
Lynch Hill Gravel Secondary A aquifer	Low	General work below ground	Excavation and construction of below ground elements of the Proposed Scheme will have the potential to interrupt groundwater flows and affect water quality.	Minor Neutral effect (Not significant)	Application of the mitigation measures set out in the draft CoCP including Section 16 will protect the aquifer.	Negligible Neutral effect (Not significant)	None	Neutral	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
<p>Lambeth Group Secondary A aquifer</p> <p>Thanet Sand Formation Secondary A aquifer</p> <p>Chalk Principal aquifer</p>	<p>High</p> <p>(assessed against highest value receptor - the Chalk Principal aquifer)</p>	<p>Tension piles</p> <p>Toe of basement walls</p>	<p>Construction of the piling for basement walls will be to approximately -18m AOD.</p> <p>The construction will be within the Lambeth Group and Thanet Sand Formation which could result in the introduction of contaminants into the aquifer from in situ concrete and cement grouts, their associated additives, and fluids in construction equipment.</p> <p>The creation of rapid pathways from overlying strata through the London Clay Formation could result in poorer quality water being introduced to the Lambeth Group and Thanet Sand Formation aquifers. However, the London Clay Formation will tend to self-seal around some piles so the method of piling will be important to determine mitigation requirements.</p> <p>The groundwater level of the underlying aquifers is between -30 and -40m AOD and as such, no groundwater will be intercepted.</p>	<p>Negligible impact</p> <p>Neutral effect</p> <p>(Not significant)</p>	<p>Application of the mitigation measures set out in the draft CoCP will control the materials used in the aquifer and prevent the creation of pathways through the London Clay Formation.</p>	<p>Negligible impact</p> <p>Neutral effect</p> <p>(Not significant)</p>	None	None	Not applicable

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Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Abstractions									
<p>SPZ located north of Regent's Park</p> <p>(Licence number confidential)</p> <p>GW92 (TH/039/0039/001)</p> <p>GW88 and GW89 (TH/039/0039/031)</p> <p>Gw85 (TH/039/0039/010)</p> <p>GW78 (TH/039/0039/022)</p>	Moderate	Tension piles Toe of basement walls	<p>The SPZ is up gradient of the Proposed Scheme in this study area.</p> <p>The direction of groundwater flow will minimise the potential for any impact on the abstraction.</p>	<p>Negligible impact</p> <p>Neutral effect</p> <p>(Not significant)</p>	Application of the measures set out in the draft CoCP will ensure groundwater quality in the Lambeth Group, Thanet Sand Formation and Chalk aquifers will not be adversely impacted.	<p>Negligible impact</p> <p>Neutral effect</p> <p>(Not significant)</p>	None	None	Not applicable

6 References

Environment Agency (2009), *River Basin Management Plan*, Thames River Basin District.

Environment Agency (2013), *Management of the London Basin Chalk Aquifer Status Report 2013*

European Commission, Water Framework Directive - *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*, Strasbourg, European Parliament and European Council.

Land Drainage Act (1991), London, Her Majesty's Stationery Office.

Water Resources Act (1991), London, Her Majesty's Stationery Office.